

CLAIMS:

1. A bipolar battery cell comprising:
a plurality of bipolar electrodes, each including a collector having a positive-electrode layer on one surface and a negative-electrode layer on another surface;
a plurality of electrolyte layers that exchange ions between the bipolar electrodes;
and
a discharge circuit that electrically conducts adjacent bipolar electrodes.
2. The bipolar battery cell of claim 1, wherein the discharge circuit is provided on the same surface of at least one layer of the positive-electrode layers, the negative-electrode layers, or the electrolyte layers.
3. The bipolar battery cell of claim 1, further comprising a contact area between the discharge circuit and the bipolar electrode that is more than 0.06 mm^2 per battery capacity of the bipolar battery 1 Ah.
4. The bipolar battery cell of claim 1,
wherein a threshold of a discharge voltage in the discharge circuit is set between 3.6 V – 4.1 V, and
wherein a doping concentration is set between 10^{17} - 10^{18} , and the thickness of a depletion layer is set between $0.1 \text{ }\mu\text{m}$ - $1.0 \text{ }\mu\text{m}$ so as to set a breakdown voltage of a PN-junction of the discharge circuit the same as to the threshold.
5. The bipolar battery cell of claim 1, wherein the discharge circuit includes a zener diode layer.
6. The bipolar battery cell of claim 1, wherein the discharge circuit includes a luminescent device.
7. The bipolar battery cell of claim 6, further comprising a light guiding device arranged between the luminescent device and an end of the battery cell.

8. The bipolar battery cell of claim 6, further comprising a light sensor that responds to light emitted from the relevant luminescent device.

9. The bipolar battery cell of claim 8, wherein the discharge circuit includes a constant current circuit.

10. The bipolar battery cell of claim 9, further comprising a sheathing material that covers and seals the bipolar electrodes, the electrolyte layers, the discharge circuit, and the light sensor.

11. The bipolar battery cell of claim 1, further comprising a sheathing material that covers and seals the bipolar electrodes, the electrolyte layers, and the discharge circuit.

12. The bipolar battery cell of claim 1, further comprising a conductive sealing material.

13. An assembled battery comprising a plurality of bipolar battery cells, wherein each bipolar battery cell comprises:

a plurality of laminated bipolar electrodes, each including a collector having a positive-electrode layer on one surface and a negative-electrode layer on another surface;

a plurality of electrolyte layers that exchange ions between the bipolar electrodes;
and

a discharge circuit that electrically conducts adjacent bipolar electrodes,
wherein the discharge circuit is provided on the same surface of at least one layer of the positive-electrode layers, the negative-electrode layers, or the electrolyte layers.

14. A vehicle comprising:
a controller; and
an assembled bipolar battery comprising a plurality of bipolar battery cells,
wherein each bipolar battery cell comprises:
a plurality of bipolar electrodes, each including a collector having a positive-electrode layer on one surface and a negative-electrode layer on another surface;
a plurality of electrolyte layers that exchange ions between the bipolar electrodes;
and
a discharge circuit that electrically conducts adjacent bipolar electrodes,
wherein the discharge circuit is provided on the same surface of at least one layer of the positive-electrode layers, the negative-electrode layers, or the electrolyte layers.
15. A method of forming a bipolar battery cell comprising:
laminating a plurality of bipolar electrodes, each including a collector having a positive-electrode layer on one surface and a negative-electrode layer on another surface;
laminating a plurality of electrolyte layers that exchange ions between the bipolar electrodes; and
laminating a discharge circuit that electrically conducts adjacent bipolar electrodes.
16. The method of claim 15, wherein the discharge circuit is provided on the same surface of at least one layer of the positive-electrode layers, the negative-electrode layers, or the electrolyte layers.
17. A bipolar battery cell comprising:
a plurality of bipolar electrodes, each including a collector having a positive-electrode layer on one surface and a negative-electrode layer on another surface;
a means for exchanging ions between the bipolar electrodes; and
a means for discharging the bipolar battery cell by electrically conducting adjacent bipolar electrodes.